

Seattle Services

— part of a multi-departmental series on applying for City services

Design Guidelines for Public Storm Drain Facilities

June 2010

This guideline explains the standard criteria to be used by civil engineers for the design of Public Storm Drain (PSD) facilities. These guidelines are general and will not necessarily be applicable in all cases. The guidelines may be modified by Seattle Public Utilities Engineering as required.

For Standard Plans of drainage system components, see the latest edition of the City of Seattle Standard Plans and Standard Specifications for Road, Bridge, and Municipal Construction.

http://www.seattle.gov/util/Engineering/Standard_Plans_&_Specs/index.asp

For requirements for flow control and treatment, see DPD's web site on Stormwater Code and related Director's Rules.

<http://www.seattle.gov/dpd/Codes/default.asp>

DESIGN CRITERIA

Pavement Replacement

1. Street and sidewalk pavement removal and replacement must follow the current Director's Rule ("Street and Sidewalk Pavement Opening and Restoration"). http://www.seattle.gov/transportation/stuse_pavementopen.htm

Storm Drain Location

2. Storm drains must be placed in the standard location according to Standard Plan 030, whenever possible. This standard location is seven feet south or west of the right-of-way centerline. The SDOT Street Use Section, in consultation with Seattle Public Utilities, must approve alternate alignments.

Cover

3. Storm drains must have at least six feet of cover over the top of the pipe and be as deep as necessary to drain the entire topographic tributary area.

Design Storm

5. Storm drains must be designed for full gravity peak flow with 4% annual probability (25-year recurrence flows. The storm drain's surcharge level (hydraulic grade line) for that peak flow may be no higher than four feet below the street's gutter elevation or one foot below the service elevation of adjacent private property, whichever is lower. The service elevation is defined as two feet below the lowest elevation served on the site (such as the lowest catch basin or footing drain.)
6. If calculations show that a storm drain is surcharged, the Hydraulic Grade Line must be shown on the pipe profiles of the contract drawings. Use the high water elevation of the receiving waters to calculate hydraulic gradients. High water for Lake Union and Lake Washington is +18.6; for Elliott Bay and the Duwamish River it is +12.14.

Size and Slope of Pipe

7. Storm drains must be a minimum of 12 inches in diameter. The minimum slope for storm drains is 0.5% with 1.0% or greater being desirable. Flatter slopes may be considered, but pipe slope must achieve a minimum velocity of three feet per second (fps) and shall require SPU approval.

Excess Energy

8. The effects of excess energy shall be investigated whenever pipe velocity exceeds 20 feet per second (fps). Energy dissipation features may be required. The design shall minimize or mitigate hydraulic jumps.

Matching Pipe at the Manholes

9. The crowns of all pipes shall match at the manholes. Invert elevations shall be calculated by projecting the pipe slopes to the center of the manholes.

Roadways and Alleys

10. Drainage shall be collected at all closed contour low points along the roadway, upstream of all intersections and crosswalks, and at the



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downstream end of developed alleys upstream of the sidewalk. If the distance from a high point to the intersection, crosswalk, or end of an alley is less than 100 feet, drainage pickup may not be necessary.

11. Arterial streets with a grade flatter than 1.0% shall have drainage pickups (catch basins and/or inlets) at least every 350 feet. Gutter flow calculations may be required.

Pipe Material

12. Clay, concrete or ductile iron pipe is the standard material for storm drains. See City of Seattle Standard Plans and Specifications. Pipe material selection shall require SPU approval.
http://www.seattle.gov/util/Engineering/Standard_Plans_&_Specs/index.asp

Manholes

13. Manholes are required every 375 feet. Generally, manholes are required at pipe junctions, breaks in grade, and changes in horizontal alignment. When a small diameter storm drain intersects a very large diameter storm drain, it may be appropriate to set the manhole on the small diameter pipe 10 to 30 feet away from the junction. Manholes are needed at the end of all pipe runs unless the pipe is 100 feet in length or shorter.
14. PSD pipe may have one horizontal or vertical bend (maximum 22.5°) between manholes, subject to approval by Seattle Public Utilities.
15. Manholes must be placed in all intersections to allow for future extensions into side streets. Stubs to the side streets shall be used to facilitate catch basin connections (see Details #1 and #2). Slope and depth of the stubs must allow future extension further into the side streets.
16. Manholes must be shown on all plans dimensioned from centerline or monument line, as appropriate. For survey requirements, see SPU CAM 1401. Manhole numbers shall start at the downstream end.

Catch Basins and Inlets

17. In alleys, use a Standard Plan 241 catch basin. Connect to Public Combined Sewer (PS) or PSD. Curb discharge requires SPU and SDOT approval.
18. Along streets, use Standard Plan 250 inlets and Standard Plan 242 catch basins. (See Detail #1.)

19. If utility interferences prevent the use of a Standard Plan 242 catch basin along a curb line, place a Standard Plan 250 inlet along the curb and connect to a Standard Plan 240A catch basin. Locate the Standard Plan 240A catch basin in the first lane of traffic as close to the curb as practical, so only one lane must be closed to traffic for maintenance (see Detail #3.)
20. Water from no more than 1000 total lineal feet of curb may discharge into one catch basin. This includes the length of curb for inlets which discharge into a catch basin as well as the catch basin itself. (See Detail #2.)
21. At closed-contour low points and other locations where extra capacity is needed, use Standard Plan 242B catch basins. At low points in the roadway use two Standard Plan 242B catch basins, one on each side of the street, each with an independent connection to the storm drain. Additional drainage structure may be required where tree leaves are prevalent.
22. Inlet and catch basins must be located upstream of curb ramps and crosswalks. The downstream edge of the inlet grate must be a minimum of one foot clear of the curb ramp landing. It is desirable to have the downstream edge of the inlet grate placed at the upstream edge of the curb ramp wing. See Standard Plan 422b for location of new curb ramps. The standard location for inlets and catch basins is one and one-half feet from the centerline of the inlet or catch basin to the point of curvature (P.C.) or point of tangency (P.T.) of the curb return. (See Standard Plan 260a and item number 23 below). For curb bulbs, see Detail #5.
23. Existing catch basins and inlets that do not conform to current standards must be replaced if located in areas where new permanent pavement will be installed. Existing inlets which do not conform with Standard Plan 250, located along new curbs, must be replaced. Whenever an inlet is replaced, the connection pipe to the catch basin or mainline must be replaced. Reconnect new catch basins to the mainline using new pipe (see Detail #4.)
24. Catch basin and inlet connections must be 8-inch in diameter and conform to Standard Plan 261. A catch basin connection to an existing 8-inch public combined sewer shall be 6 inches in diameter.
25. The maximum length of an inlet connection is 50 feet without bends at a minimum slope of 5%.
 - a. For curb bulbs, a Standard Plan type 242B catch basin shall be located 1½ feet from

the PC or PT of the curb bulb. A Standard Plan type 250 inlet may be used only if the longitudinal slope is greater than the cross slope and connected to a Standard Plan type 240A catch basin (located in the traveled roadway.) See Detail #5.

- b. Standard Plan 240C and 240D may be used in lieu of Standard Plan 242 for design cases where a higher outlet pipe is needed.

Roadway Grade

26. The minimum allowable roadway grade is 0.5% with 1.0% being desirable. The minimum road way cross slope is 2.0%. Guidelines for roadway grades can be found in the City of Seattle Right of Way Improvement Manual.
<http://www.seattle.gov/transportation/rowmanual/>

Curbs and Gutters

27. Generally, a Standard Plan 410B curb and gutter must be used with asphalt paving and a Standard Plan 410C doweled curb must be used with concrete or asphalt-overlaid concrete paving.

Detention

29. Detention constructed for ROW improvements may be installed only with approval from SPU. Detention pipes are required unless it can be shown that a vault is the only feasible solution. The detention facility shall meet Standard Plan 272. If manhole lids are located on a non-vehicular surface, a locking lid must be provided. Catch basins shall not be connected to the flow control manhole.

Treatment

29. Stormwater Treatment constructed for ROW Improvements requires approval from SPU.

Green Stormwater Infrastructure (GSI)

30. Guidelines for GSI, such as permeable paving, bioretention and natural drainage systems (NDS) can be found in the City of Seattle Right-of-Way Improvements Manual.
<http://www.seattle.gov/transportation/rowmanual/>

ADDITIONAL RESOURCES

Drainage and Sewer Easements

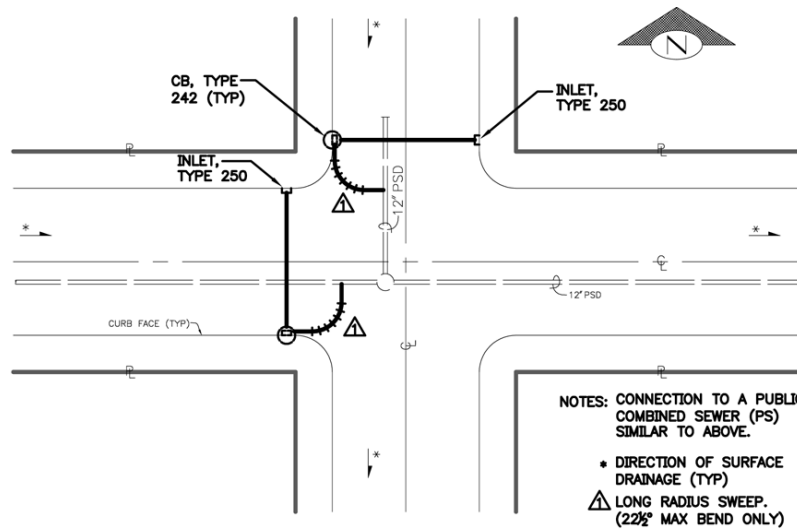
Inside (Nominal) Diameter of Pipe	Minimum* Easement
<=16"	12'
>16" – 24"	14'
>24" - 36"	16'
>36" – 48"	18'
60"	20'
72"	24'
84"	28'
96"	32'
108"	36'
120"	40'

*Site conditions may require larger easement.

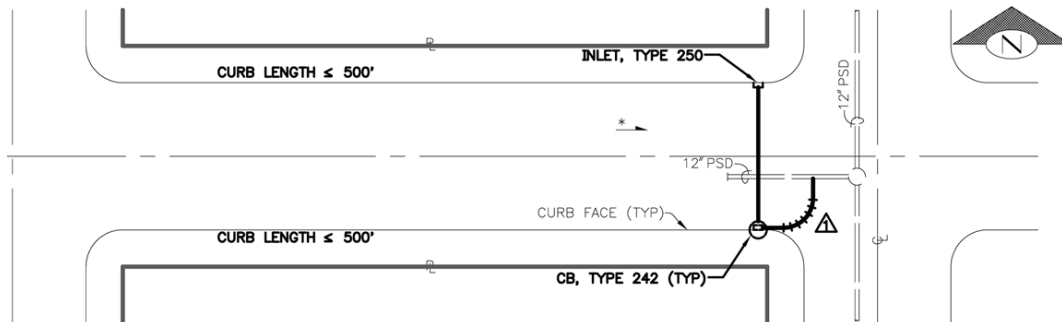
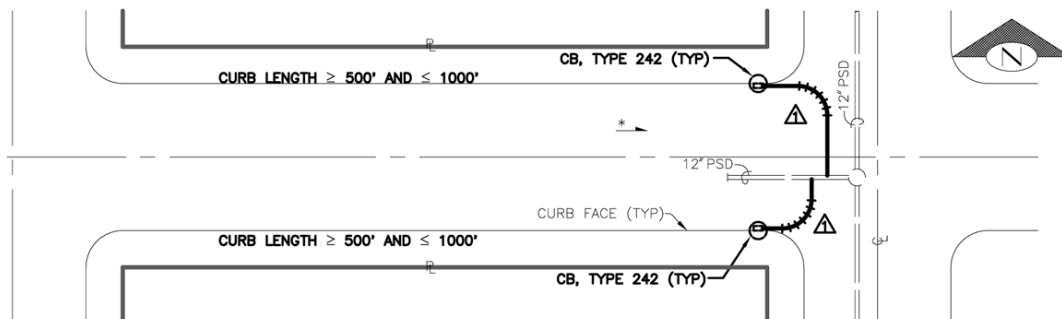
General Sewage and Drainage Notes

This is a link to the SDOT web site containing these notes:

<http://www.seattle.gov/transportation/pdf/GeneralSewerDrainageNotes.pdf>

**DETAIL****TYPICAL INLET/CATCH BASIN LAYOUT AT AN INTERSECTION**

NTS

1**INLET/CB LAYOUT FOR TOTAL CURB LENGTH 500 LF AND UNDER****CB LAYOUT FOR TOTAL CURB LENGTH FROM 500 TO 1000 LF**

NOTES: CONNECTION TO A PUBLIC COMBINED SEWER (PS) SIMILAR TO ABOVE.

* DIRECTION OF SURFACE DRAINAGE (TYP)

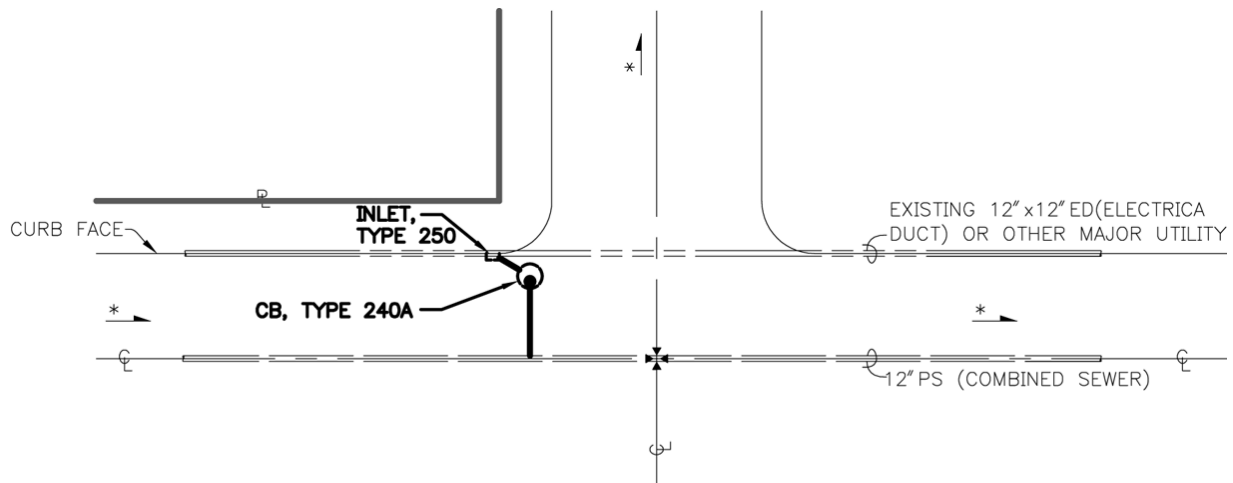
△ LONG RADIUS SWEEP. (22½° MAX BEND ONLY)

DETAIL**INLET/CATCH BASIN LAYOUTS ON LONG BLOCK**

NTS

2

P:\Tr\C353501_cad+cam\typical_CB-Inlet_layouts.dwg, Layout Tab: DETL 1 & 2

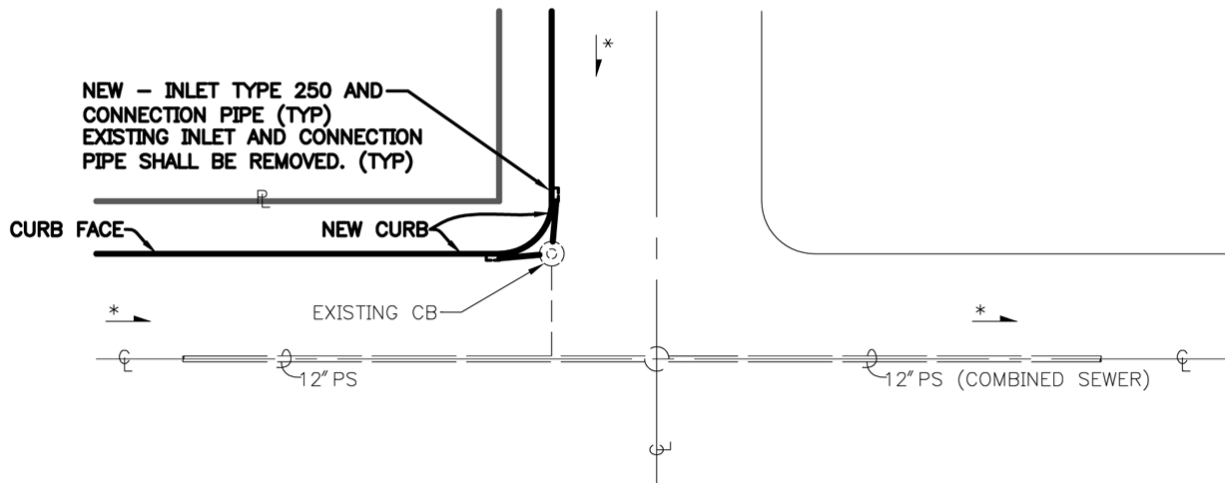
**DETAIL****ALTERNATIVE DRAINAGE FACILITY PLACEMENT**

NTS

NOTES: TO BE USED ONLY WHEN MAJOR EXISTING UTILITIES CONFLICT
STANDARD CB PLACEMENT.

* DIRECTION OF SURFACE DRAINAGE (TYP)

3
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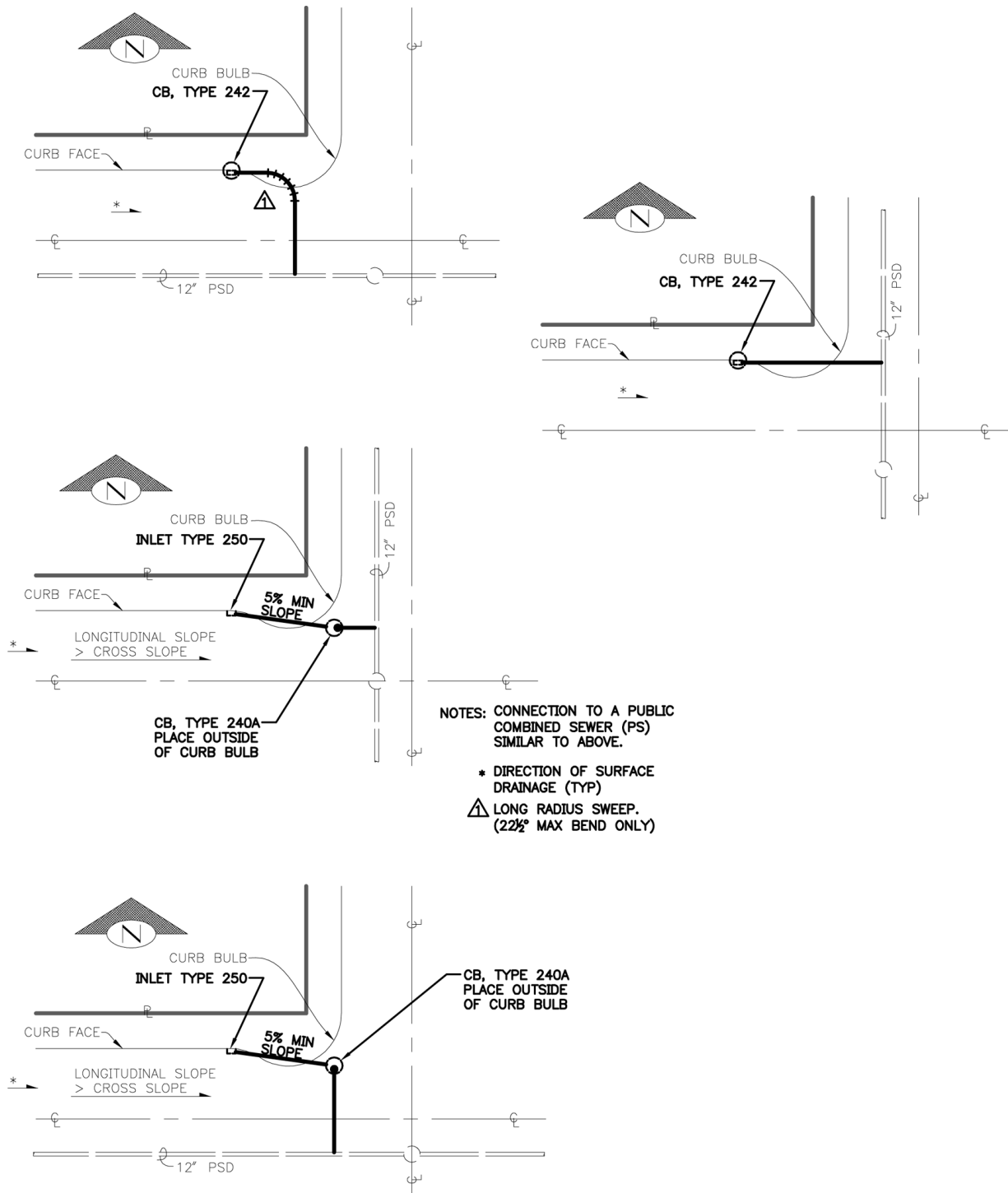
**DETAIL****INLET PLACEMENT ALONG NEW CURB**

NTS

NOTES: EXISTING CATCH BASIN IS NOT REQUIRED TO BE REPLACED IF LOCATED OUTSIDE
NEW PAVEMENT AND CONSIDERED TO BE IN GOOD WORKING CONDITION.

* DIRECTION OF SURFACE DRAINAGE (TYP)

4
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DETAIL

INLET/CATCH BASIN LAYOUT AT CURB BULBS

5

NTS

P:\Tr\C353501 cad+cam\typical CB-Inlet layouts.dwg Layout Tab: DFTI 5